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# मानक

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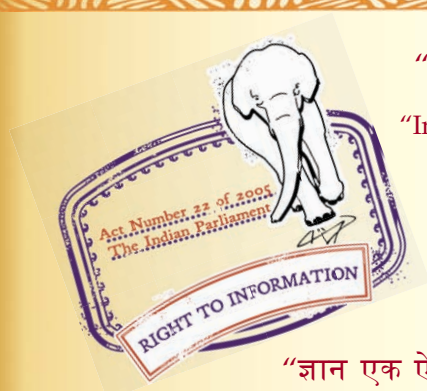
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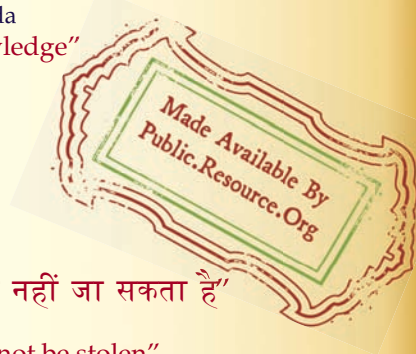
IS 8872-2-1 (1979): Variable Resistors, Part 2: General Purpose, Section 1: Type VR1C [LITD 5: Semiconductor and Other Electronic Components and Devices]



“ज्ञान से एक नये भारत का निर्माण”

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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”







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Indian Standard

## SPECIFICATION FOR VARIABLE RESISTORS

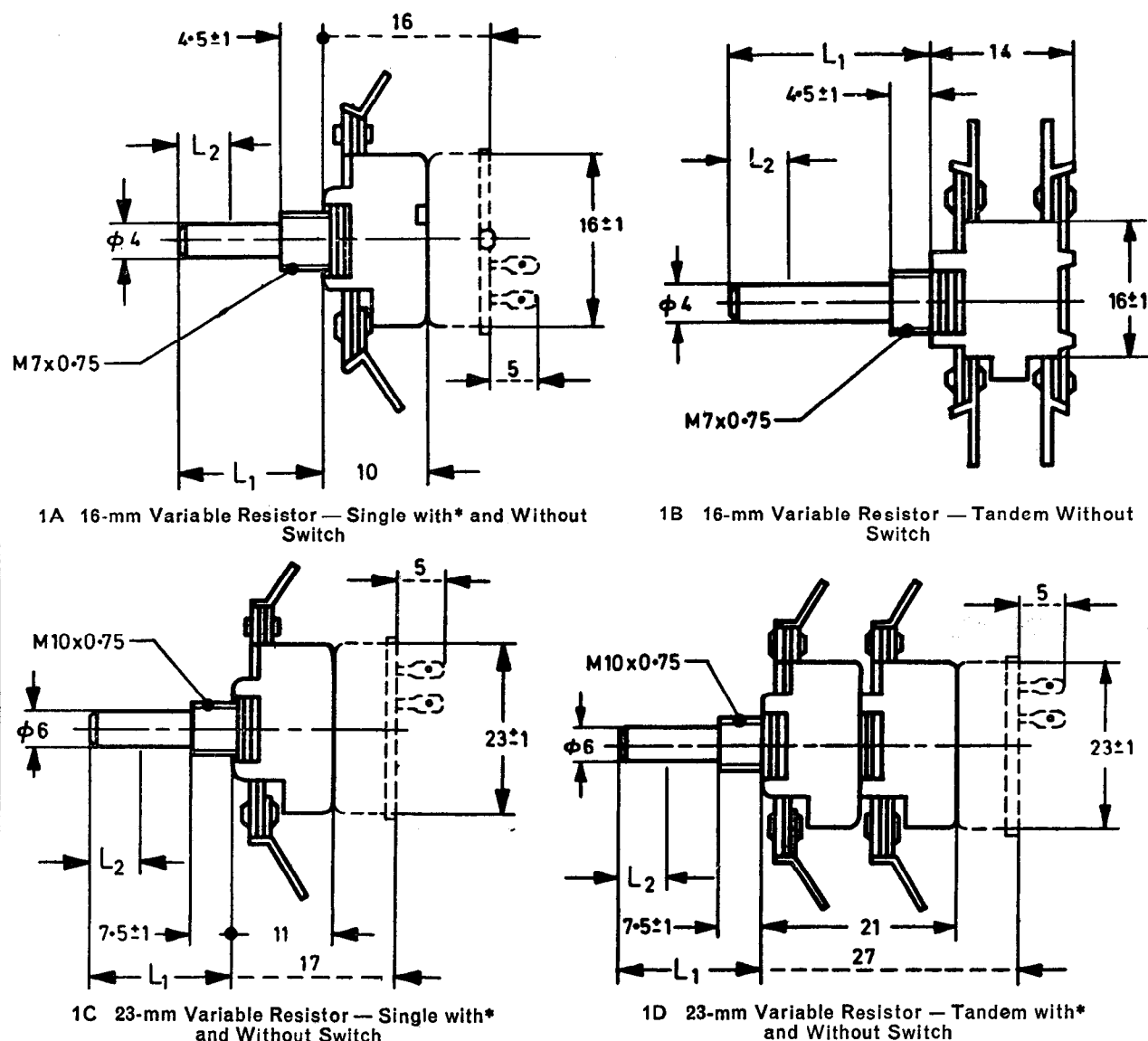
## PART II GENERAL PURPOSE

## Section 1 Type VRG1C

**0. General** — This standard shall be read in conjunction with IS : 8872 (Part I) - 1977 'Specification for variable resistors: Part I General requirements and methods of tests'.

**1. Scope** — Covers non-wire wound, general purpose variable resistors of rotary type required for commercial applications.

**2. Outline Drawing and Dimensions** — The outline drawing and dimensions shall be according to Fig. 1.



\*Switch shown in interrupted outline.

All dimensions in millimetres.

FIG. 1 OUTLINE DRAWING AND DIMENSIONS

Adopted 12 July 1979

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P 10.05

Gr 6



3. Ratings and Characteristics

a) Electrical ratings	See Table 1
b) Mechanical characteristics	See Table 2
c) Selection tolerance	± 20 percent
d) Stability class:	
1) Electrical	± 10 percent
2) Mechanical	± 15 percent
e) Temperature characteristic of resistance	± 1 200 ppm/°C
f) Maximum surface temperature	100°C
g) Mechanical endurance	10 000 cycles
h) Typical construction	Nonwire-wound ( carbon track )

TABLE 1 ELECTRICAL RATINGS

Style	Rated Dissipation at 40°C	Resistance Range ( E3 Series )	Resistance Law	Rated Limiting Element Voltage $V_{dc}$ or $V_{rms}$	Angle of Effective Rotation
(1)	(2)	(3)	(4)	(5)	(6)
	W				
VRG1C-0.25A	0.25	100 Ω to 4.7 M Ω	Law A ( linear )	250	235 to 250°
VRG1C-0.125B	0.125	1 k Ω to 4.7 M Ω	Law B ( forward log )	250	235 to 250°
VRG1C-0.1A	0.1	100 Ω to 4.7 M Ω	Law A ( linear )	250	235 to 250°
VRG1C-0.05B	0.05	1 k Ω to 4.7 M Ω	Law B ( forward log )	250	235 to 250°

4. Climatic Severities

a) Temperature severity	10/70
b) Damp heat severity	21 days
c) Bump	4 000, 10 g
d) Vibration	10-55 Hz, 10 g, 3 × 2 hours
e) Shock	Not applicable
f) Acceleration	Not applicable
g) Low air pressure	Not applicable
h) Rapid change of temperature	Not applicable

5. Derating — Variable resistors covered by this standard are derated linearly from 100 percent rated dissipation at 40°C to zero dissipation at 100°C through 50 percent dissipation at 70°C. The dissipation at temperatures below 40°C is the rated dissipation. Reference should be made to the derating curve shown below to find out dissipation at other temperatures.

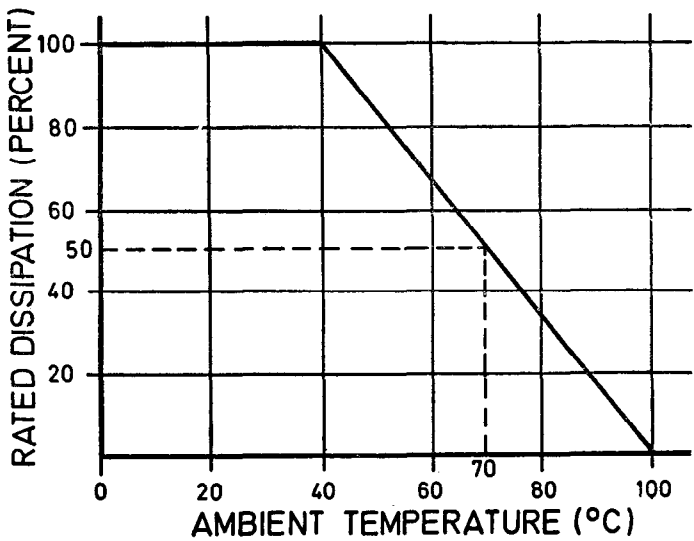




TABLE 2 MECHANICAL CHARACTERISTICS

[ Clause 3 (b) ]

Style	Type	Total Mechanical Rotation	Starting Torque	End Stop Torque ( Max )	Locking Torque ( Max )	Switching Torque
(1)	(2)	(3)	(4)	(5)	(6)	(7)
			g.cm	kg.cm	kg.cm	g.cm
VRG1C—0·25A	i) Single without switch	270 ± 5°	35 — 500	8	12·5	Not applicable
	ii) Single with switch	270 ± 5°	35 — 500	8	12·5	400 - 800
	iii) Tandem without switch	300 ± 5°	35 — 500	8	12·5	Not applicable
	iv) Tandem with switch	300 ± 5°	35 — 500	8	12·5	400 - 800
VRG1C—0·125B	i) Single without switch	270 ± 5°	35 — 500	8	12·5	Not applicable
	ii) Single with switch	270 ± 5°	35 — 500	8	12·5	400 - 800
	iii) Tandem without switch	300 ± 5°	35 — 500	8	12·5	Not applicable
	iv) Tandem with switch	300 ± 5°	35 — 500	8	12·5	400 - 800
VRG1C—0·1A	i) Single without switch	270 ± 5°	35 — 500	3·5	10·0	Not applicable
	ii) Single with switch	270 ± 5°	35 — 500	3·5	10·0	150 - 400
	iii) Tandem without switch	300 ± 5°	35 — 500	3·5	10·0	Not applicable
VRG1C—0·05B	i) Single without switch	270 ± 5°	35 — 500	3·5	10·0	Not applicable
	ii) Single with switch	270 ± 5°	35 — 500	3·5	10·0	150 - 400
	iii) Tandem without switch	300 ± 5°	35 — 500	3·5	10·0	Not applicable

**Note** — Mounting length of spindle ( $L_1$ ), flat length ( $L_2$ ) for flatted spindle and slot dimensions for slotted spindle, shall be chosen from IS: 4586 (Part I/Sec 2)-1978\*, IS: 4536 (Part I/Sec 3)-1978\* and IS: 4535 (Part I/Sec 4)-1979\*, for the corresponding spindle diameter.

\*IS: 4586 Dimensions of spindles and mounting arrangements of spindle operated electronic components,

(Part I/Sec 2)-1978: Part I Spindles, Section 2 Plain round spindles.

(Part I/Sec 3)-1978: Part I Spindles, Section 3 Flatted spindle.

(Part I/Sec 4)-1978: Part I Spindles, Section 4 Slotted spindle.



**IS : 8872 ( Part II/Sec 1 ) - 1979**

**6. Marking** — See 6 of IS : 8872 ( Part I ) - 1977.

**7. Material, Construction and Workmanship** — See 5 of IS : 8872 ( Part I ) - 1977.

**8. Tests****8.1 Classification of Tests**

**8.1.1 Type tests** — The sequence of type tests and grouping of samples for type approval shall be in accordance with Table 3.

**TABLE 3 TYPE TESTS**

SI No.	Title of Test	Number of Samples			Clause Ref in IS : 8872 ( Part I ) - 1977
		Highest Value	Middle Value	Lowest Value	
(1)	(2)	(3)	(4)	(5)	(6)
i) Group 0					
a)	Visual examination	16	16	16	9.1
b)	Dimensions				9.1.1
c)	Electrical continuity				8.1
d)	Total resistance				8.2
e)	Terminal resistance				8.3
f)	Attenuation				8.4
g)	Effective resistance and angle of effective rotation				8.6
h)	Resistance law				8.7
i)	Matching of resistance law ( for tandem types only )				8.14
k)	Switch contact resistance ( for types with switch only )				8.8
m)	Voltage proof				8.9
n)	Insulation resistance				8.10
p)	Noise				8.12
q)	Operating torque				9.2
r)	Switching torque				9.3
s)	End-stop torque				9.4
t)	Locking torque				9.5
u)	Thrust and pull on spindle				9.6

( Continued )



TABLE 3 TYPE TESTS — *Contd*

SI No.	Title of Test	Number of Samples			Clause Ref in IS : 8872 ( Part I )- 1977
		Highest Value	Middle Value	Lowest Value	
(1)	(2)	(3)	(4)	(5)	(6)
ii) Group 1					
	a) Robustness of terminations	4	4	4	9.7
	b) Solderability				9.8.3
	c) Bump				9.10
	d) Vibration				9.9
	e) Climatic sequence				10.1
iii) Group 2					
	Damp heat ( long term )	2	2	2	10.2
iv) Group 3					
	Mechanical endurance	2	2	2	11.3
v) Group 4					
	Electrical endurance	2	2	2	11.4
vi) Group 5					
	Resistance to soldering heat	2	2	2	9.8.4
vii) Group 6					
	Temperature characteristic of resistance	2	2	2	8.11
	Spares	2	2	2	—

**8.1.1.1** The manufacturer shall submit for each rated dissipation, the number of samples as given below:

Highest value	16*
Middle value	16*
Lowest value	16*

**8.1.2 Routine tests** — The following tests shall be carried out on each and every resistor:

- a) Visual examination,
- b) Electrical continuity, and
- c) Total resistance.

**8.1.2.1** If during routine tests, more than 10 percent of the lot fails, the entire lot may be rejected.

**8.1.3 Acceptance tests** — For the purpose of the acceptance of the lot, all the resistors shall be subjected to the tests as given in 8.1.2. Following this two groups of samples ( Group A and B ) shall be selected and the resistors shall be subjected to the tests specified in Table 4 in the given order.

\*Of these 16 samples, 14 are required for carrying out the type tests and two are to be kept as spare.



**IS : 8872 ( Part II/Sec 1 ) - 1979**

**8.2 General Conditions for Tests** — See 7 of IS : 8872 (Part I)-1977. The same measuring set shall be used for any one test but not necessarily for all tests.

**8.2.1** The test schedule with test conditions and requirements after each test applicable to variable resistors covered by this standard shall be in accordance with Table 5.

**TABLE 4 ACCEPTANCE TESTS**

SI No.	Test	Clause Ref in IS : 8872 (Part I)-1977	AQL (Percent Defective)	Inspection Level	D/ND
(1)	(2)	(3)	(4)	(5)	(6)
i) Group A			1 percent	II	
	a) Dimensions	9.1.1			
	b) Resistance law	8.7			
	c) Voltage proof (two seconds duration)	8.9			
	d) Operating torque	9.2			
	e) Locking torque	9.5			
	f) Noise	8.12			
ii) Group B					
Sub-group B <sub>1</sub>			4 percent	S3	N
	a) Solderability	9.8.3			
Subgroup B <sub>2</sub>			4 percent	S3	D
	a) Resistance to soldering heat	9.8.4			
	b) Robustness of terminations	9.7			
	c) Endurance (mechanical)	11.3			
	d) End stop torque	9.4			
Subgroup B <sub>3</sub>			4 percent	S3	D
	a) Vibration	9.9			
	b) Climatic sequence	10.1			
Subgroup B <sub>4</sub>			4 percent	S3	
	a) Endurance electrical (168 h)	11.4			

D = Destructive, and

ND = Non-destructive.

**Note** — For each group/sub-group, separate samples shall be drawn.



TABLE 5 TEST SCHEDULE AND REQUIREMENTS

( Clause 8.2.1 )

SI No.	Test	Clause Ref in IS : 8872 ( Part I )-1977	Condition of Test	Requirement
(1)	(2)	(3)	(4)	(5)
l) All Samples				
a)	Visual examination	9.1	—	The workmanship and finish shall be satisfactory. The marking shall be legible
b)	Dimensions	9.1.1	—	The dimensions of the resistors and their terminations shall conform to values given in Fig. 1
c)	Electrical continuity	8.1	—	There shall be no discontinuity
d)	Total resistance	8.2	—	The resistance value at 25°C shall correspond with the rated resistance taking into account the tolerance
e)	Terminal resistance	8.3	—	The minimum terminal resistance at either end of the resistor shall not exceed the values given in Appendix A
f)	Attenuation (for Law B variable resistors having values $> 1 \text{ k } \Omega$ only)	8.4	—	Shall be greater than 50 dB
g)	Effective resistance and angle of effective rotation	8.6	—	As in Table 1
h)	Resistance law	8.7	Setting in percent of total electrical rotation	Output resistance ratio in percent shall not exceed the limits:
1)	Law A		47 to 53	i) 40-60 for resistance $< 220 \text{ k } \Omega$ ii) 35-65 for resistance $\geq 220 \text{ k } \Omega$
2)	Law B		i) 30-36 ii) 64-70	i) 1.5-8 ii) 10-40
j)	Matching of resistance law (for tandem types only)	8.14	—	The ratio of the two voltages or the differences expressed in decibels shall be within the limits:
				i) Law A
				At any point between 10% and 90% of the total resistance value the ratios $\frac{V_{ab}}{V_{ac}}$ ( or $\frac{V_{bc}}{V_{ac}}$ ) of either of the two variable resistors shall not exceed 1.25 times the corresponding momentary ratio of the other variable resistor
				ii) Law B
				$20 \log \frac{V_{ab}}{V_{ac}}$ Maximum permissible difference between the attenuation of the two section
				0-20 dB 2dB
				20-30 dB 3dB
				30-40 dB 4dB
				Over 40 dB No requirements

( Continued )



TABLE 5 TEST SCHEDULE AND REQUIREMENTS — *Contd*

SI No.	Test	Clause Ref in IS : 8872 (Part I)-1977	Condition of Test	Requirement
(1)	(2)	(3)	(4)	(5)
k)	Switch contact resistance (for types with switch only)	8.8	—	For spindle > 16 mm Less than 25 m ohms For spindle ≤ 16 mm Less than 20 m ohms
m)	Voltage proof	8.9	—	There shall be no breakdown or flashover
	1) For variable resistors	8.9.2	Test voltage of 1 000 V at 50 Hz shall be applied	
	2) For switch	8.9.3	i) For spindle diameter ≤ 16 mm test voltage 500 V ii) For spindle diameter > 16 mm test voltage 2 000 V ac at 50 Hz	
n)	Insulation resistance	8.10	—	i) For carbon track ≥ 1 000 MΩ ii) For switch ≥ 100 MΩ
p)	Contact resistance variation	8.12.4	—	Contact resistance shall not exceed for i) Law A 6 percent of R <sub>n</sub> ii) Law B 8 percent of R <sub>n</sub>
q)	Operating torque	9.2	—	35-500 g.cm
r)	Switching torque	9.3	—	i) 150-400 g.cm for 16 mm resistor ii) 400-800 g.cm for 23 mm resistor
s)	End stop torque	9.4	—	i) 33 kg.cm <i>Max</i> for 16 mm resistor ii) 8 kg.cm <i>Max</i> for 23 mm resistor
t)	Locking torque	9.5	—	i) 10 kg.cm <i>Max</i> for 16 mm resistor ii) 12.5 kg.cm <i>Max</i> for 23 mm resistor
u)	Thrust and pull on spindle	9.6	—	—
	1) Visual examination	9.1	—	There shall be no visible damage
	2) Electrical continuity	8.1	—	There shall be no electrical discontinuity
	3) Total resistance	8.2	—	The change in resistance value shall not exceed ±2 percent
ii) <i>First Group</i>				
a)	Robustness of terminations	9.7	—	There shall be no visible damage
b)	Solderability	9.8.3	—	There shall be no visible damage and the tinning shall be good
c)	Bump	9.10	4 000, 10 g	—
	1) Visual examination	9.1	—	There shall be no visible damage
	2) Electrical continuity	8.1	—	There shall be no electrical discontinuity
	3) Total resistance	8.2	—	The change in resistance value shall not exceed ± 2 percent
d)	Vibration	9.9	10-55 Hz, 10 g, 6 h	—
	1) Visual examination	9.1	—	There shall be no visible damage
	2) Electrical continuity	8.1	—	There shall be no electrical discontinuity
	3) Total resistance	8.2	—	Change in resistance value shall not exceed ± 2 percent

( Continued )



TABLE 5 TEST SCHEDULE AND REQUIREMENTS — *Contd*

SI No.	Test	Clause Ref in IS : 8872 ( Part I )-1977	Condition of Test	Requirement
(1)	(2)	(3)	(4)	(5)
e) Climatic sequence		10.1	—	—
1) Dry heat		10.1.2	At upper category temperature ( + 70°C )	—
Visual examination		9.1	—	After recovery there shall be no visible damage and marking shall be legible
2) Damp heat ( accelerated ) first cycle		10.1.3	One cycle of 24 h at $55 \pm 2^\circ\text{C}$ and RH of 95 - 100 percent with no voltage applied	—
Visual examination		9.1	—	There shall be no damage and marking shall be legible
3) Cold		10.1.4	At lower category temperature ( - 10°C )	—
i) Visual examination		9.1	—	There shall be no damage and marking shall be legible
ii) Operating torque		9.2	—	Operating torque shall not exceed three times the initial requirement
iii) Switching torque		9.3	—	Switching torque shall not exceed two times the initial requirement
4) Low air pressure		10.1.5	During the last 5 minutes of the test, voltage proof test shall be carried out subject to the air pressure ( low ) voltage limitation	During and after this test there shall be no sign of breakdown or flash-over
5) Damp heat ( accelerated ) remaining cycles		10.1.6	—	—
i) Visual examination		9.1	—	There shall be no visible damage and the marking shall be legible
ii) Total resistance		8.2	—	The change in resistance value shall not exceed $\pm 20$ percent
iii) Insulation resistance		8.10	—	The insulation resistance shall not be less than 25 M $\Omega$ for carbon track and 2 M $\Omega$ for switch
iv) Switch contact resistance		8.8	—	The switch contact resistance shall not exceed 40 m.ohms
v) Electrical continuity		8.1	—	There shall be no electrical discontinuity
vi) Operating torque		9.2	—	Initial limits
vii) Voltage proof		8.9	—	There shall be no breakdown or flash-over
iii) <i>Second Group</i>				
a) Damp heat ( long term )		10.2	Half the number of specimens shall be loaded with a direct voltage of 20 V between the movable contact and case ( movable contact being positive )	—

( Continued )



TABLE 5 TEST SCHEDULE AND REQUIREMENTS — *Contd*

SI No.	Test	Clause Ref in IS : 8872 ( Part I )-1977	Condition of Test	Requirement
(1)	(2)	(3)	(4)	(5)
	1) Visual examination	9.1	—	There shall be no damage and the marking shall be legible
	2) Total resistance	8.2	—	The change of resistance shall not exceed $\pm 20$ percent
	3) Insulation resistance	8.10	—	Resistor: 25 M $\Omega$ , <i>Min</i> Switch: 2 M $\Omega$ , <i>Min</i>
	4) Switch contact resistance	8.8	—	The switch contact resistance shall not exceed 40 m.ohms
	5) Electrical continuity	8.1	—	There shall be no electrical discontinuity
	6) Operating torque	9.2	—	Initial limits
	7) Contact resistance variation	8.12.4	—	Law A $\leq 4$ percent of $R_n$ Law B $\leq 8$ percent of $R_n$
	8) Voltage proof	8.9	—	There shall be no breakdown or flashover
iv) <i>Third Group</i>				
	a) Mechanical endurance	11.3	10 000 cycles at the rate of 10-15 cycles/ <i>Min</i>	—
	1) Variable resistor	10.3.1	—	—
	i) Visual examination	9.1	—	There shall be no visible damage
	ii) Total resistance	8.2	—	The change in resistance value shall not exceed $\pm 15$ percent
	iii) Terminal resistance	8.3	—	—
	iv) Insulation resistance	8.10	—	1 000 M $\Omega$ , <i>Min</i>
	v) Operating torque	9.2	—	—
	vi) Electrical continuity	8.1	—	—
	vii) Thrust and pull on spindle	9.6	—	—
	viii) Voltage proof	8.9	—	There shall be no breakdown or flashover
	ix) Contact resistance variation	8.12.4	—	Shall be within initial limits
	2) Switch	10.3.2	—	—
	i) Visual examination	9.1	—	There shall be no visible damage
	ii) Operating torque	9.2	—	Initial limits
	iii) Insulation resistance	8.10	—	Shall not be less than initial limits
	iv) Switch contact resistance	8.8	—	Shall not exceed 200 m.ohms
	v) Voltage proof	8.9	—	There shall be no breakdown or flashover
v) <i>Fourth Group</i>				
	a) Electrical endurance	11.4	—	—
	i) Visual examination	9.1	—	There shall be no damage
	ii) Total resistance	8.2	—	Change in resistance value shall not exceed $\pm 10$ percent
	iii) Insulation resistance	8.10	—	Shall not be less than 10 000 M $\Omega$ , for variable resistors
	iv) Contact resistance variation	8.12.4	—	Shall be within the initial limits
vi) <i>Fifth Group</i>				
	a) Resistance to soldering heat	9.8.4	—	—
	i) Visual examination	9.1	—	There shall be no visible damage
	ii) Total resistance	8.2	—	Change in resistance value shall not exceed $\pm 2$ percent
vii) <i>Sixth Group</i>				
	Temperature characteristic of resistance	8.11	—	$\pm 1\,200$ ppm/ $^{\circ}\text{C}$



## APPENDIX A

[ Table 5, SI No. 1(e) ]

TABLE 6 TERMINAL RESISTANCE

SI No.	Rated Resistance		Maximum Value of Minimum Resistance		
	Greater Than	Less Than or Equal to	Clockwise and Counter Clockwise	Counter Clockwise	Clockwise
			Law A	Law B	Law B
(1)	(2)	(3)	(4)	(5)	(6)
i)	—	500Ω	50Ω	—	—
ii)	500Ω	1 kΩ	50Ω	5Ω	50Ω
iii)	1 kΩ	5 kΩ	50Ω	5Ω	100Ω
iv)	5 kΩ	10 kΩ	50Ω	10Ω	200Ω
v)	10 kΩ	25 kΩ	50Ω	10Ω	440Ω
vi)	25 kΩ	50 kΩ	50Ω	50Ω	1 kΩ
vii)	50 kΩ	0.1 MΩ	100Ω	100Ω	2 kΩ
viii)	0.1 MΩ	0.25 MΩ	220Ω	220Ω	4.4 kΩ
ix)	0.25 MΩ	0.50 MΩ	470Ω	470Ω	9.4 kΩ
x)	0.50 MΩ	1 MΩ	1 kΩ	1 kΩ	20 kΩ
xi)	1 MΩ	2.5 MΩ	2.2 kΩ	2.2 kΩ	4.4 kΩ
xii)	2.5 MΩ	5 MΩ	4.7 kΩ	4.7 kΩ	94 kΩ